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China Automotive Vision Industry Report, 2022

Sept.2022

China automotive vision research: DMS is booming, with the installations soaring 141.8% year-on-year

1. China will install 75.4 million cameras in 2025

According to ResearchInChina, China installed 20.624 million cameras in new cars in 2022H1, a year-on-year increase of 11.8%. By market segments, the installations of front view cameras increased by 20.4% year-on-year to 3.499 million units in 2022H1; the installations of surround view cameras jumped by 22.7% year-on-year to 10.735 million units; the installations of rear view cameras decreased by 18.8% year-on-year to 4.52 million units; the installations of DMS cameras swelled by 141.8% year-on-year to 384,000 units; the installations of driving recorders ascended by 39.7% year-on-year to 1.486 million units.

Installations of Cameras in Chinese Passenger Cars, 2021-2022

Time	Front view camera	Surround view camera	Rear view camera	DMS	Driving recorder	**Total**
Jan-Jun 2021	2.906 million	8.747 million	5.564 million	159,000	1.064 million	**18.44 million**
Jan-Jun 2021	3.499 million	10.735 million	4.52 million	384,000	1.486 million	**20.624 million**
YoY growth	20.4%	22.7%	-18.8%	141.8%	39.7%	**11.8%**

Source: ResearchInChina

Installation Rate of L2 and Higher-level Autonomous Driving Functions

China will install 75.4 million cameras in 2025 under the impulse of following factors:

1) Policies

The state and cities have actively launched policies related to autonomous driving in order to promote development and commercialization of autonomous driving industry. On March 1, 2022, China officially implemented "Autonomous Driving Classification" as a new national standard. On August 1, Shenzhen officially enforced "Regulations on Administration of Intelligent Connected Vehicles in Shenzhen Special Economic Zone", allowing fully autonomous vehicles to hit the road. On September 5, Shanghai issued "Implementation Plan for Accelerating Innovation and Development of Intelligent Connected Vehicles in Shanghai", stipulating that Shanghai should initially build a leading domestic innovation and development system for intelligent connected vehicles by 2025.

2) OEMs

In 2022H1, 2.877 million vehicles boasted L2+ functions, accounting for 32.4% which jumped 12.6 percentage points year-on-year. In particular, the installation rate of L2.5 and L2.9 ticked up dramatically. Many OEMs are deploying L3 and higher-level autonomous driving. In the later stage, autonomous driving above L2.9 will become standard.

Installation Rate of L2 and Higher-level Autonomous Driving Functions in Chinese Passenger Cars, 2020-H1 2022

Driving level		2020	2021	YoY growth	H1 2021	H1 2022	YoY growth
L2+	Installations	3,031,324	4,788,220	58.0%	1,977,479	2,876,964	45.5%
	Installation rate	16.1%	23.6%	7.5 percentage points	19.8%	32.4%	12.6 percentage points
L2	Installations	2,836,313	4,209,363	48.4%	1,770,577	2,446,386	38.2%
	Installation rate	15.1%	20.7%	5.6 percentage points	17.7%	27.6%	9.9 percentage points
L2.5	Installations	193,282	501,274	159.3%	202,976	334,111	64.6%
	Installation rate	1.0%	2.5%	1.5 percentage points	2.0%	3.8%	1.8 percentage points
L2.9	Installations	1,729	77,583	-	3,926	96,467	2357.1%
	Installation rate	0.01%	0.4%	0.4 percentage points	0.04%	1.09%	1.05 percentage points

(Note: L2+=L2+L2.5+L2.9)

Source: ResearchInChina

Traditional OEMs deploy autonomous driving by partnering with technology companies or launching new brands. For example, BYD teamed up with NVIDIA and Baidu in February and March 2022 respectively. NVIDIA will provide intelligent driving technology, and Baidu will offer a complete solution for L3 intelligent driving. In March 2022, GAC released its new electric brand "e:NP" and the first battery-electric vehicle "e:NP1" under the brand to embody "electrification". The vehicle enables L3 intelligent driving.

Emerging automakers focus on independent development. NIO, Li Auto and Xpeng have successively embarked on full-stack self-research of software and algorithms. Xpeng's full-stack self-developed XPilot driving assistance system has continuously upgraded. Currently, XPilot 3.5 can make L3 autonomous driving possible. XPilot 4 is now available on G9, and it is scheduled to complete the transition to autonomous driving in 2026.

Top 10 Front View Camera Suppliers for new Passenger Cars in China by Market Share

2. 2022H1, Bosch, Denso, and Aptiv enjoyed 52.28% share of the front view camera market, and Chinese local player Jingwei Hirain Technologies was shortlisted in the top ten

In 2022H1, Chinese front view camera market for new passenger cars was mainly occupied by foreign suppliers like Bosch, Denso, and Aptiv. Bosch grasped the market share of 25.12% by serving BYD, Honda, BMW, Changan, etc. Denso secured the market share of 19.09% as a partner of Toyota. The market share of Aptiv whose main customers included Volvo, GAC, SAIC, etc. hit 8.27%.

Jingwei Hirain Technologies is the only Chinese local company that ranked among the top 10 front view camera suppliers for new passenger cars in China. Established in 2003, Jingwei Hirain Technologies entered ADAS field in 2016, mainly serving OEMs such as SAIC, FAW, Geely, etc.. Its main products include ADCU, ADAS, LMU, DMS, T-BOX, GW, etc., among which ADAS cameras have evolved to the fifth generation. In the future, a new generation of super-high-computing-power intelligent driving domain controllers, intelligent cockpit perception controllers, 3D cameras and other new products will be developed for domestic chips or foreign higher-computing-power chips, ISP technology, and in-cockpit three-dimensional perception technology.

TOP10 Front View Camera Suppliers for New Passenger Cars in China by Market share, H1 2022

Ranking	Suppliers	Share
1	Bosch	25.12%
2	Denso	19.09%
3	Aptiv	8.27%
4	ZF	6.47%
5	Veoneer	5.82%
6	Tesla	5.64%
7	Kostal	5.00%
8	Hirain	3.94%
9	Panasonic	3.36%
10	Continental	2.98%

Source: ResearchInChina

The 8-megapixel era of automotive cameras began

3. The 8-megapixel era of automotive cameras began

As autonomous driving levels up, the demand for automotive cameras is reflected in perception lenses instead of imaging lenses, and the application scenarios have expanded from simple scenarios to multi-directional scenarios. Besides, the system has higher and higher requirements for camera resolution. Driven by market demand, 8-megapixel cameras with higher definition, wider field of view and longer detection distance are more and more favored by OEMs.

Of the models launched in 2022, those with 8-megapixel cameras account for a higher proportion than before. For example, Li L9 and NIO ES7 unveiled in June 2022 are equipped with 11 cameras each; specifically, Li L9 has six 8-megapixel cameras, and NIO ES7 boasts seven 8-megapixel cameras. WM M7, which will debut in 2022Q4, will feature a total of 11 cameras (including seven 8-megapixel cameras) which cover all scenarios ranging from parking in compounds, urban roads to intercity expressways.

8-megapixel Camera Layout of Models Launched in 2022

Model	WM M7	Li L9	NIO ES7
Number of cameras installed outside the vehicle	11	11	11
Number of 8-megapixel cameras	7	6	7
Installation location of 8-megapixel cameras	2 front view cameras; 4 side view cameras; 1 rearview camera	2 front view cameras; 4 side view cameras	1 front-view binocular camera; 2 front view cameras; 2 side rear view cameras; 1 rearview camera
Detection distance and FOV	The farthest detection distance: >600 meters, Single camera FOV: 120° ultra-wide angle	The farthest detection distance: 550 meters, FOV: 120°	-
8-megapixel camera supplier	Front view monocular camera: MINIEYE	-	Lianchuang Electronic Technology

Freetech FVC3

With the support of OEMs for assisted driving functions, suppliers have begun to vigorously deploy R&D and production of high-resolution camera modules. For example, the third-generation front view camera FVC3 released by Freetech in August 2022 has 8 megapixels, the farthest vehicle detection distance of 250 meters, and the farthest pedestrian detection distance of 120 meters. It bolsters Navigate on Autopilot (NOA) on expressways and recognition of Chinese traffic signs and scenarios.

8-megapixel Camera Layout of Some Suppliers in China

Vendors	Front view trinocular camera	Front view binocular camera	Front View Monocular Camera	Surround view camera	Side view camera	Inside camera
DJI	-	Mass-produced	Mass-produced	Mass-produced	-	-
Huawei	-	Mass-produced	-	-	-	-
oToBrite	-	Mass-produced	-	-	Mass-produced	-
OFILM	-	To be mass-produced	-	-	-	-
Jingwei Hirain Technologies	-	-	Mass-produced	-	Mass-produced	-
Freetech	-	-	Designated by multiple mainstream automakers	-	-	-
Neusoft Reach		Designated	To be mass-produced			
Zongmu Technology	Mass production in Q3 2022	-	Mass production in Q3 2022	-	-	-
iMotion	-	-	-	Later layout of surround view and fisheye cameras	-	-

3D Sensing Technology

4. 3D Sensing Technology

3D sensing is a depth sensing technology that can measure and collect the height, depth and shape of objects. Compared to traditional solutions, 3D ToF can capture depth and infrared images under harsh lighting conditions with a higher lens frame, which is more suitable for dynamic scenarios. At present, 3D sensing technology is mainly used in the interior of the cockpit, such as DMS.

As the mainstream technical solutions of 3D sensing, structured light and ToF technology have become the hotspots of major automotive lens vendors for technical breakthrough. OFILM is currently the main supplier of 3D sensing modules in China. In 2017, OFILM made a layout in this field, and developed structured light and ToF solutions simultaneously. It took the lead in the mass production of automotive ToF visual perception modules for AITO M5 released in March 2022 as a pioneer in the automotive industry.

Oradar will release its 3D ToF smart cockpit solution in September 2022.

AITO M5 Equipped with OFILM's Automotive ToF Module

ArcSoft's latest 3D ToF gesture interaction technology debuted on Li L9 in June 2022.

Li L9 Equipped with ArcSoft's 3D ToF Sensor

DMS/OMS will see a surge in Installations

5. As an important part of smart cockpit, DMS/OMS will see a surge in installations

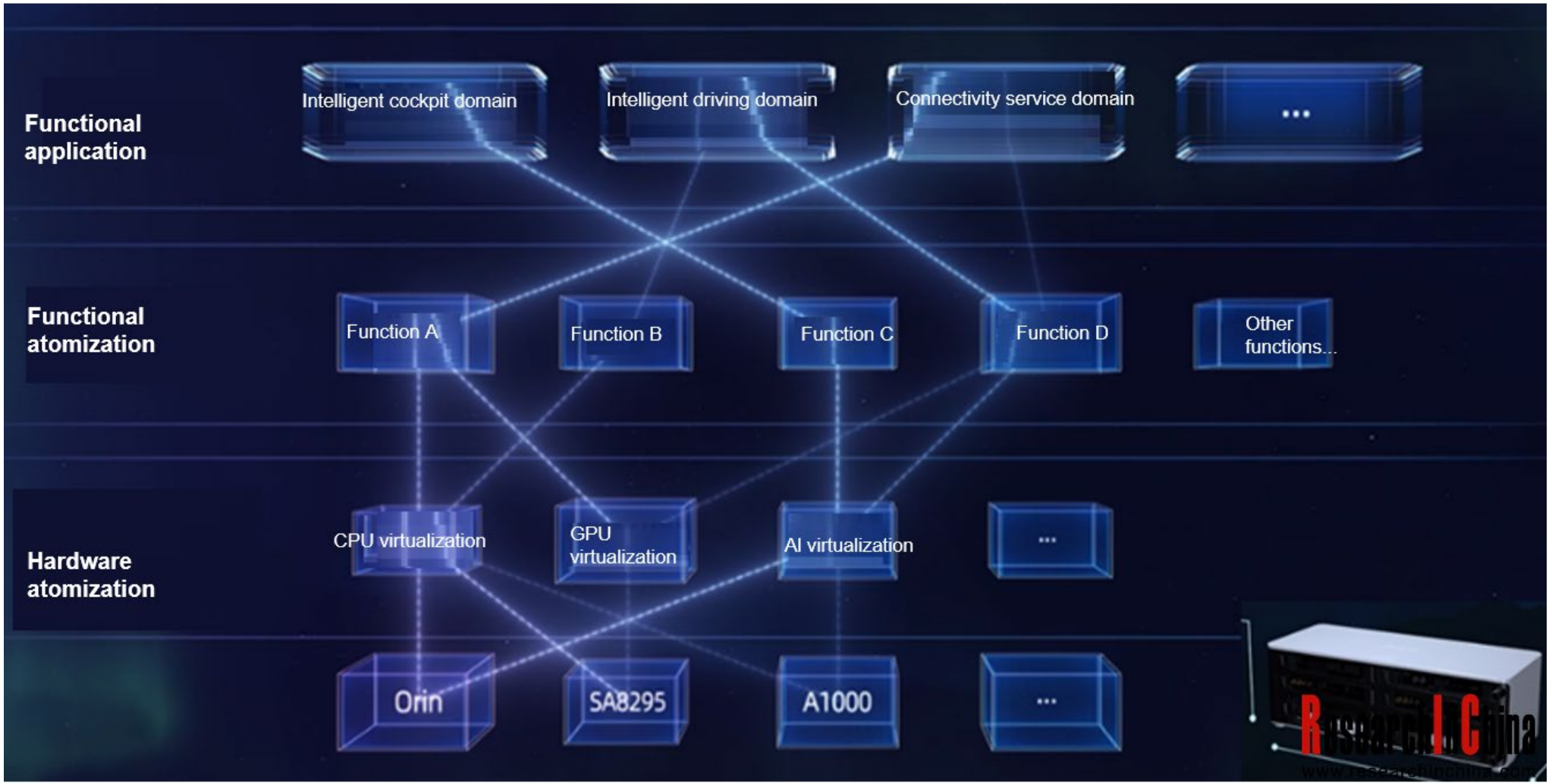
In 2022H1, DMS installations swelled by 141.8% year-on-year to 384,000 units. The current mainstream DMS solutions can be divided into cockpit integrated solutions and independent hardware solutions. Integrated cockpit solutions offer rich functions and mobile phone interconnection in terms of entertainment functions and social media functions. Independent hardware solutions can meet the requirements of L2+ and L3 autonomous driving in view of functional safety level, and effectively monitor the state of human-machine co-driving.

Mainstream providers of independent hardware solutions include Neusoft Reach, Suzhou INVO, OFILM, and Hikvision. In particular, Neusoft Reach's independent hardware DMS solution has conducted functional safety development in accordance with ISO2 6262 ASIL-B in terms of system, hardware and software, and has realized deployment of full-chain information security modules on controller, vehicle, cloud, and mobile phone. Combined with L3 intelligent driving domain controller of vehicle, it has been mounted on mainstream models of many automakers.

In the future, when autonomous driving technology enters an advanced stage and people need not act as drivers, the scenario application of smart cockpit will become more important. The key to the perfect user experience depends on cockpit-driving integration. Therefore, a number of domestic vision suppliers have launched solutions that integrate the interior and exterior of the cockpit.

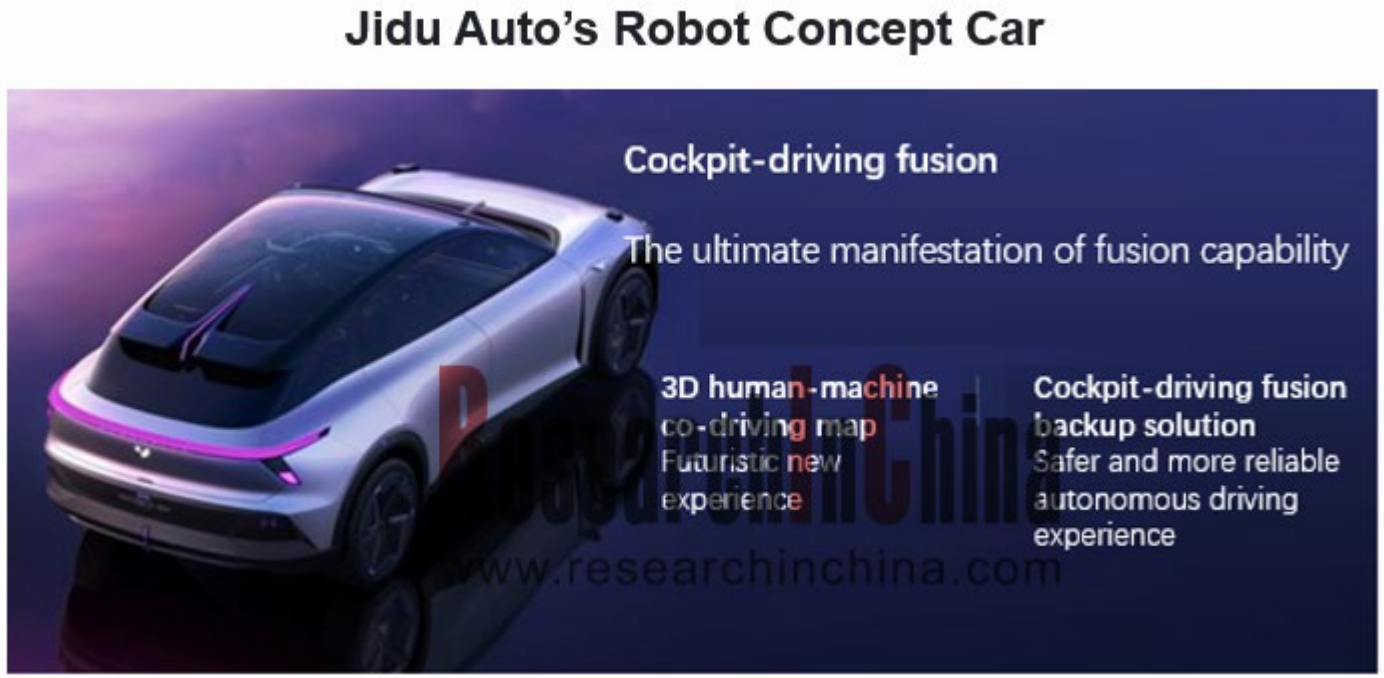
In April 2022, Desay SV released automotive intelligent computer "Aurora", marking the company's leap from a domain controller to a central computing platform. This cockpit-driving fusion solution, based on multiple SoCs, integrates multiple functional domains such as intelligent cockpit, intelligent driving, and connected services at the functional level.

Desay SV's Central Computing Platform: Aurora



Jidu Auto’s Robot Concept Car

In June 2022, Jidu Auto launched a "robot" concept car. Based on self-developed SOA cockpit-driving fusion technology architecture, it allows computing power sharing, perception sharing, and service sharing. The intelligent cockpit domain controller can support system-level security redundancy when the intelligent driving system fails, and the intelligent driving domain controller enables AI interaction of intelligent cockpit 3D human-machine co-driving map.



Layout Planning of Some Domestic Suppliers for Integrating Interior and Exterior of the Cockpit

Suppliers	Planning
MINIEYE	At the 2021 Shanghai Auto Show, MINIEYE launched a global perception solution, including a L2+ and lower-level ADAS solution for the out-of-cockpit perception, as well as DMS, OMS, in-cockpit interaction, object monitoring and other functions for the in-cockpit perception. It aims to offer an ADAS+DMS global intelligent driving solution.
Jingwei Hirain Technologies	The intelligent cockpit perception system SCSS of Jingwei Hirain Technologies can deeply integrate ADAS, T-BOX, body, HD map and other information, as well as create integrated smart cockpit solutions.
Autocruis	Autocruis plans to work with Ambarella to advance an in-vehicle/out-of-vehicle IMS+ADAS joint perception system.
Hikvision	Hikvision is actively exploring an intelligent driving & intelligent cockpit integration application solution.

Business Layout of Some Vision Suppliers in China

	Front view camera		Surround view camera	Side view camera	Rear view camera	Inside camera
	Monocular camera	Others				
Jingwei Hirain Technologies	√	√	√	√	√	√
Neusoft Reach	√	√	√	√	√	√
OFILM	√	√	√	√	√	√
Suzhou INVO	√	√	√		√	√
MAXIEYE	√					
Freetech	√					
Tsingtech Microvision	√			√	√	√
Autocruis	√		√	√		√
Streamax Technology	√			√	√	√
iMotion	√					
Hikvision	√	√	√		√	√
Desay SV	√	√		√		√

Table of Content (1)

Table of Content (2)

Table of Content (3)

Table of Content (4)

Table of Content (5)

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